PERFORMANCE BASED STANDARDS
IN NEW ZEALAND

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Outline

- Evolution of PBS
- NZ - 1980s
- VDAM Rule 2002
- HPMVs - 2010
- Proposed new NZ PBS system
- Conclusions
Evolution of PBS

- Concept is not new
  - Some performance standards go back to 1920s
- In 1980s, Canadian RTAC study used performance standards to characterise the fleet
- NZ among the first jurisdictions to use PBS for:
  - Informing size and weight regulation
  - Permitting non standard vehicle configurations
Performance measures used to inform prescriptive limits
- Weight increase from 39t to 44t was only available to configurations with good performance characteristics
- Additional safety requirements for 44t vehicle

Performance standards used for permitting vehicles outside prescriptive limits
- E.g. 44t A-trains required to have SRT > 0.45g, LTR < 0.6, HSTO < 0.5m
Vehicle Dimensions and Mass Rule

- In 2002, all of the vehicle size and weight regulations were consolidated into a “Rule”.
- Some performance standards included in regulations in 2002
- HPMVs introduced in 2010. Permits based on performance. Prescriptive dimensional envelopes were developed with no assessment required.
High Productivity Motor Vehicles

- In 2010, VDAM Rule was amended to allow HPMVs
- The regulator was empowered to allow larger and heavier vehicles to operate provided that they were safe and that the infrastructure could handle them
- The amendment specified no upper limits on length or weight
- HPMV axle weight limits and bridge formula limits were defined
HPMV Implementation

- Defined a new low speed turning performance standard – based on performance of worst case standard legal vehicle
- Promoted the concept of pro-forma designs
- General access at standard legal weights
- Route-specific access at higher weights
- Lengths 22m → 22.3m → 23m
Typical Pro-Forma Design

23m Truck and full-trailer

Please fill in the boxes with your vehicle’s dimensions

Note 1  Axle groups can be replaced with alternate groups at the same axis points

Note 2  Max. is lesser of 4300 or 50% of wheelbase
Strong uptake by volume-constrained operators

Non pro-forma designs could be permitted with a PBS assessment

Higher weights required route-specific permits which could involve multiple RCAs

Some local RCAs reluctant to allow higher weights on their infrastructure
50 MAX Vehicles

- NZTA and Transport Industry initiated concept of 50MAX vehicle
  - 50 tonnes GCW (instead of 44 tonnes)
  - Minimum of 9 axles
  - Complies with standard bridge formula
- No increase in pavement wear
- General access to network with only a few exclusions
Typical 23m HPMV

- 44t general access
- 50t on 50MAX routes
- 58t on approved routes
One-off Designs
How has it worked?

- Unitary government structure allows rapid adoption.
- Pragmatic approach of using PBS as a basis for prescriptive framework.
- Low cost and strong uptake. Approx 50% of combination vehicles are HPMVs
- Some problems with over-shoot. Concerns that some PBS limits too liberal.
Current NZ PBS Approach

- Has used a mix of Canadian, Australian and home grown measures
- Not formally defined
- Limited number of approved assessors
- Generally has performed satisfactorily – vehicles behave as expected
Proposed New NZ PBS System

- Accept that some prescriptive limits are unavoidable
- Accept that some performance measures cannot easily be obtained experimentally
- Maximise compatibility with Australian PBS system
- Set pass/fail criteria based on NZ conditions
Prescriptive Requirements

These are constraints imposed by the infrastructure. They include:

- Vehicle width
- Vehicle height
- Vehicle overall length
- Axle weights and axle group weights
- Axle spacing
- Combined axle set weight and spacing limits
- Tyre size and pressure
Drivetrain Requirements

- Australian PBS has performance standards for these:
  - Startability
  - Gradeability – low speed and high speed
  - Acceleration capability

- NZ PBS we are proposing to control these aspects by prescriptive requirements as a proportion of vehicle weight:
  - Minimum proportion of total weight on drive axles
  - Minimum clutch engagement torque-to-weight at the wheels
  - Minimum peak torque-to-weight at the wheels
  - Minimum peak power-to-weight
Low Speed Turning Performance

- Same manoeuvre as Australian PBS -12.5m outside radius, 90 degree turn
- Same low speed swept width measure but more restrictive pass/fail criterion
- Same tail swing
- Simplified frontal swing criteria – slightly more liberal
- Simplified steer-tyre friction demand requirement. More restrictive
Steady State Low-Speed Swept Width

- On lower speed highway curves, actual off-tracking is a combination of low speed and high speed effects.
- Standard 90° turn does not reliably capture steady state low speed off-tracking performance.
- Proposed manoeuvre is 25m radius wall-to-wall turn EC (1992)
- Performance measure is swept width
- Maximum allowable level is 5.20m
Meeting this standard at greater than 0.35g is already part of the requirements for most large heavy vehicles.

For HPMVs the standard has been toughened. HPMVs must meet 0.35g and be fitted with RSC or meet an SRT of 0.4g.

The proposal for the PBS system is that the 0.35g requirement is retained.
The test manoeuvre proposed is a high speed lane of 1.46m executed over 2.5s at 88km/h as defined in ISO 14791. This is the same as the Australian PBS system.

Three performance measures will be evaluated

- Load Transfer Ratio
- Rearward Amplification
- High Speed Transient Off-tracking
The proposed test manoeuvre is the pulse steer input specified in the Australian PBS system.

The performance measure quantifies the rate at which the trailer oscillations decay.

The requirement is that the yaw damping ratio should exceed 0.15.

This is identical to the Australian requirements.
Some performance measures are sensitive to tyre and suspension properties.

Australian PBS approvals specify tyre make and model, suspension make and model and even gearbox and differential make and model.

Generic suspensions and tyres simplify the issue but may under-estimate performance.
Conclusions

- Proposed low speed turning performance requirements are more restrictive than those used for pro-forma designs
- All pro-forma designs would need to be re-worked
- Other PBS requirements are similar to those currently used
- Australia is considering (two or three) standard classes of tyres. Should stay consistent with this
- Need to develop processes for approving assessors